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CONSTRUCTION LAYOUT NO. 1

VERTICAL CURVES

This exercise involves vertical curve calculations and is the first in a series of the courses for construction Layout. Whether you are a beginner or expert in vertical curve design and layout, this exercise will sharpen your skills.

A vertical curve is a parabolic curve not a circular curve. The beginning of the curve is the PVC. The end of the curve is the EVC. Vertical distances between the tangent and the curve are called tangent offsets. The point of intersection of the tangents is called the vertex or PVI, the point of vertical intersection. The middle of the curve is called the midpoint.

Generally, the tangents are fitted to existing topography and the elevations of the PVI points are selected. The grades of the back and forward tangents are calculated at each station. Tangent offsets are computed and subtracted from the corresponding tangent elevations. Intermediate points are calculated along the vertical curve for curb inlets, street intersections, and horizontal curve points.

The formula of a parabola or vertical curve is:

$$Y = ax2 + bx + c$$

or elev = r/2 times the station squared + g1 times the station plus the elevation of the PVC.

The station of the PVC = the station of the vertex minus the length of curve / 2.

The station of the EVC = the station of the vertex plus the length of curve / 2.

The elevation of the PVC = the elevation of the vertex minus g1 times the length of curve / 2.

The elevation of the EVC = the elevation of the vertex plus g2 times the length of curve / 2.

Rate of change r = (g2-g1)/L

The station of the high or low (sag) point of the curve = -g1/r.

The tangent offset at the PVI is L(g2-g1)/8

Given: PVI = Sta 5+00, elev of PVI = 100.00, g1 = 4%, g2 = -2%, LC = 800.

The tangent offset at the PVI is 8(-2-4)/8 = -6.00 feet

Rate of change = -2 - 4 / 8 or -.75

The station of the high point = -4 / -.75 = 5.33 stations from the PVC
or 5 minus 4 + 5.33 or Sta 6+33

The elevation of the high point is 100 minus 2.67 plus
(2.67/4)(2.67/4)(-6.00) = 94.67 feet

The station of the PVC is 5 minus 8/2 or 1+00.

The station of the EVC is 5 plus 8/2 or 9+00.

The elevation of the PVC is 100 minus 4 times 8/2 = 84.00

The elevation of the EVC is 100 minus 2 times 8/2 = 92.00

The tangent offset at the PVC is 0.

The tangent offset at 2+00 is (1/4)(1/4)(-6.00) = -.38

The tangent offset at 3+00 is (2/4)(2/4)(-6.00) = -1.50

The tangent offset at 4+00 is (3/4)(3/4)(-6.00) = -3.38

For questions 1 through 20

Given: PVI at Sta 5+00 & elevation = 200.00 feet, g1 = 3%, g2= -1%, length of vertical curve = 600 feet.

For questions 21 through 40

Given: PVI at Sta 5+00 & elevation = 270.00 feet, g1 = 2%, g2= -3%, length of vertical curve = 800 feet.

For questions 41 through 60

Given: PVI at Sta 5+00 & elevation = 380.00 feet, g1 = 2%, g2= -4%, length of vertical curve = 800 feet.

Note: For any question asking for a curve elevation that is before the PVC or after the EVC, the curve elevation and the tangent elevation will be the same.

STUDY GUIDE, REFERENCES, AND BIBLIOGRAPHY

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